

## **ADJUSTABLE BICYCLE SEAT POST ASSEMBLY**

### **BACKGROUND OF THE INVENTION**

#### **1. Field of the Invention**

[0001] The invention relates generally to adjustable bicycle seat posts, and more particularly to a sliding seat post within a post that allows a bicycle seat to be adjusted while a bicycle is being ridden.

#### **2. Description of the Related Art**

[0002] For those engaged in competitive cycling, such as the sport of mountain biking, it is sometimes advantageous to adjust the position of the body while riding in order to optimize the control and power over the bike. For instance, when descending a steep hill, a rider sometimes will drop back behind the bicycle seat in order to lower the body position and thereby gain more control over the bike. At most other times, such as on flat terrain, it is most advantageous for the rider to be seated on the bicycle seat in order to achieve optimum pedal power.

[0003] Another challenge faced by competitive mountain bikers is that the various components of the bike are subjected to exposure to water, mud, dirt and other debris which can quickly impair the proper operation of various moving parts.

[0004] Various adjustable-height bicycle posts have been proposed which enable a user to vary the height of the seat between two or more positions while riding. The posts are typically in the form of a telescoping tube structure that is mounted at its lower end one end in the receptacle of a bicycle frame in place of a conventional one-piece fixed length bicycle post, and which carries a seat at its opposite upper end. Some form of a locking mechanism is provided which selectively

locks the tubes in one of two or more positions. In some cases, a spring is provided which acts to constantly bias the tubes toward an extended condition.

[0005] None of the adjustable seat post configurations presently known to the inventors is believed to be satisfactory to withstand the rigors of competitive mountain biking. It is believed that the latching mechanisms are too weak to withstand the constant pounding they would encounter while supporting the weight of the rider over rough terrain. Moreover, some of the locking mechanisms are external and others, while at least in part internal, are insufficiently protected against the intrusion of dirt, mud, water and other debris that would be certain to disable the operation of the locking mechanisms in short order. There is further the general inability to readily disassemble the locking mechanism and other moving components in order to clean the dirt and debris out of the assembly to restore proper operation in the event the assembly is fouled.

[0006] It is an object of the present invention to overcome or greatly minimize the forgoing disadvantages of prior adjustable bicycle seat post assemblies.

#### **SUMMARY OF THE INVENTION AND ADVANTAGES**

[0007] The invention provides an adjustable bicycle seat post assembly comprising an inner tube telescopically supported within an outer tube. A lower end of the outer tube is dimensioned to be received in a receptacle of a bicycle frame in order to mount the outer tube firmly to the bicycle frame. The inner tube is slidable relative to the outer tube in order to adjust the effective length of the telescopic tubes. The outer tube houses a spring which acts between the outer and inner tubes and constantly biases the inner tube toward an extended condition. A locking mechanism is fixed to the outer tube and includes a locking pin which extends through an opening

in the outer tube. The inner tube has at least two longitudinally spaced openings that are selectively alignable with the opening of the outer tube during movement of the inner tube relative to the outer tube. When so aligned, the locking pin is extendable into the opening of the inner tube in order to lock the inner tube against longitudinal movement relative to the outer tube against the force of the spring. The portion of the pin extending into the inner tube opening is fully supported to its inner distal end by the wall of the inner tube opening. The portion of the pin extending through the outer tube opening is likewise fully supported and is further supported by a wall of a housing of the locking mechanism projecting radially outwardly of the outer tube.

[0008] Such full support of the locking pin by the inner and outer tubes as well as the reinforced housing provides robust support to the tubes sufficient to withstand the constant pounding and shear force that the pin is subjected to during competitive use. The hollow tubular structure reduces the weight of the structure.

[0009] According to another aspect of the invention, the locking mechanism is able to be readily disassembled to allow for cleaning of the mechanism in the event dirt and other debris enter the mechanism.

[00010] According to a further aspect of the invention, an adjustable height tube-in-a-tube bicycle post assembly is provided having a spring which constantly acts to extend the tubes and a magnetic locking mechanism. The locking mechanism has a set of magnets which act to selectively move a locking pin and thereby extend or retract the pin. When retracted, the inner tube is freely slidable relative to the outer tube. When extended, the pin is positionable into alignable openings of the inner and outer tubes to thereby lock the tubes against relative movement. The magnetic

locking mechanism provided a very simple, reliable, robust means of quickly and efficiently locking and unlocking the tubes on the fly.

[00011] According to a further aspect, the invention contemplates that the magnetic locking mechanism can be used in conjunction with other than adjustable bicycle seat posts. The magnetic locking mechanism per se comprises a housing supporting a slidable locking pin and housing a set of oppositely polarized magnets. The magnets are supported by a slide shoe which is slidable relative to the housing and which selectively moves one or the other of the magnets into position to either repel or attract the locking pin, causing the pin to slidably extend or retract relative to the housing. Such a magnetic locking mechanism is simply constructed, is comprised of few parts, and is very effective in operating the movement of the pin.

### **THE DRAWINGS**

[00012] These and other features and advantages of the present invention will become more readily appreciated when considered in connection with the following detailed description and appended drawings, wherein:

[00013] Figure 1 is a schematic view of a bicycle having the adjustable seat post mounted thereon;

[00014] Figure 2 is an exploded view of a first embodiment of the adjustable seat post assembly;

[00015] Figure 3 is an enlarged cross-sectional view of the assembly shown in the lowered position;

[00016] Figure 4 is a view like Figure 3, but shown in the raised position;

[00017] Figure 5 is a view like Figures 3 and 4, but shown in an intermediate position;

- [00018] Figure 6 is a perspective view of the locking mechanism housing;
- [00019] Figure 7 is an enlarged fragmentary perspective view of the magnetic latch mechanism;
- [00020] Figure 8 is an exploded perspective view of an assembly according to a second embodiment of the invention;
- [00021] Figure 9 is a perspective view of the assembly of Figure 8 shown in a lowered position;
- [00022] Figure 10 is a view like Figure 9, but shown in the raised position;
- [00023] Figure 11 is a sectional view taken generally along lines 11-11 of Figure 9;
- [00024] Figure 12 is an enlarged cross-sectional view of the assembly of Figure 9;
- [00025] Figure 13 is a view like Figure 12, but shown in the raised position;
- [00026] Figure 14 is a side view of the latch housing;
- [00027] Figure 15 is a plan view of the latch housing; and
- [00028] Figure 16 is a partially exploded perspective view of the manual latch mechanism.

### **DETAILED DESCRIPTION**

[00029] Referring to the Figures, wherein like numerals indicate like parts throughout the several views, an adjustable bicycle seat assembly is shown generally at 20.

[00030] Referring now to Figure 1, the seat post assembly 20 comprises a hollow inner seat post or tube 22 that slides inside a hollow outer tube 24 along a longitudinal axis 26, and a locking mechanism 28 interconnecting the post 22 in

various adjustable positions relative to the tube 24. The locking mechanism 28 may be manipulated through various means to engage or release the post 22, as described in more detail below. There are two alternative representative embodiments of locking assemblies according to the invention, one remote actuated magnetic switch assembly 29 as shown in Figures 1-7 and the other a manual release assembly 30 as shown in Figures 8-16. Their respective constructions and operations will be described below.

[00031] Preferably, the outer tube 24 is fabricated of a lightweight corrosion-resistant metal having thin walls, and the post 22 is composed of a lightweight metal having thicker walls than that of the outer tube 24. The preferred material for the inner and outer tubes 22, 24 is aluminum or an aluminum alloy, although the invention is not to be limited by these materials.

[00032] Referring now additionally to Figures 2-5, the outer tube 24 is configured at its lower end to be slidably received in a conventional seat post receptacle in the frame 31 of a bicycle 34 in the usual manner of a conventional, single-tube bicycle seat post 22. The opposite upper end of the inner tube 22 is fitted with a bracket 36 suitable for mounting a bicycle seat or saddle 40 to support the weight of a rider.

[00033] As best shown in Figures 2 and 11, a pair of shims 42, preferably fabricated of plastic, are removably inserted into notches 44 on the inner post 22 to glide in vertical grooves 46 located inside the outer tube 24 along the longitudinal axis 26. The shims 42 allow the post 22 to move up or down relative to the outer tube 24, but support the inner post 22 post against rotational movement relative to the outer

tube **24**. After a period of use and wear, the plastic shims **42** may be inexpensively replaced to prolong the life-span of the bicycle seat assembly **20**.

[00034] A top ring cap **50** is carried about an extended portion of the inner post **22** that extends above the outer tube **24** and is threadable onto the outside of the upper end of the outer tube **24** to provide a serviceable connection between the tubes **22,24** that prevents them from separating from one another during normal use, but yet enables a user to disassemble the tubes in order to clean the interior or replace worn or broken components as the need arises. The ring cap **50** forms a water and debris-tight seal with the outer tube **24** and further has a hole **52** through which the post **22** extends presenting an annular wiping lip that rides against the inner post **22** and which preferably provides a water and debris-resistant ring seal about the relatively slidable inner post **22** to discourage the entry into the inner tube **24**. Preferably, the top ring cap **50** is fabricated of a lightweight plastics material, such as nylon or the like. An O-ring seal **56** is also preferably disposed about the post **22** below the top cap **50** to enhance the sealing characteristics of the top ring cap **50**.

[00035] A seat clamp collar **58** integral with the post **22** is located at the bottom of the seat clamp mount **36** and defines a collar diameter greater than the diameter of the top cap central hole **52**. The collar **36** defines a stop surface or shoulder for the inner post **22** which confronts the top ring cap **50** when the inner post is in a fully distended or retracted position. The top ring cap **50** thus serves to not only couple the inner and outer tubes **22,24** but to limit their travel to define fully extended and retracted positions of the tubes **22,24**. Additionally, a bushing or sleeve **62**, which is preferably fabricated of a plastics material such as nylon or the like, is disposed about the post **22** between the shims **42** and top cap **50**. A body of the sleeve **62** extends

into the outer tube 24 through its open top and serves as a bearing to take up the annular operating clearance between the inner and outer tubes 22, 24. A top flange 64 of the sleeve 62 is captured between the top ring cap 50 and the top end of the outer tube 24 to support the sleeve 62 in position. When in the fully extended position, the shims 42 of the inner post 22 preferably contact the body of the sleeve 62 to effectively limit the outward travel of the inner post 22 relative to the outer tube 24. The sleeve 62 is readily removable from the outer tube 24 during disassembly to accommodate cleaning and/or servicing of the assembly as needed.

[00036] The bottom end of the outer tube 24 is open and is closed by a removable end cap 70. Preferably, the lower end of the outer tube 24 is internally threaded and the end cap 70 is externally threaded. The end cap 70 is threaded into the outer tube 24 to close the lower end, but yet the end cap 70 remains separable to allow access to the bottom of the post 22. The bottom cap nut 70 is preferably fabricated of a lightweight metal compatible with that of the outer tube material to minimize corrosion, such as aluminum or aluminum alloys, and includes a hex shaped tool-receiving recess 72 for receiving a wrench for tightening and loosening the end cap 70. The end cap 70 supports the lower end of a main compression spring 76 housed within the outer tube 24. The upper end of the spring 76 abuts a shoulder or collar 74 provided on the inner post 22 adjacent its lower end. The spring 76 acts in compression between the end cap 70 and the shoulder 74 to exert a recoil spring force that constantly urges the inner post 22 longitudinally outwardly of the outer tube 24 toward the fully extended position. The main spring 76 force (spring rate) can be adjusted by threading the bottom cap nut 70 toward or away from the shoulder 74.



[00037] Referring now to Figures 6 and 7, the locking mechanism 28 includes a foundation or housing 80 disposed on the outside of the tube 24 and a projection portion 82 integral with the foundation 80 extending radially from the longitudinal axis 26 to a distal end 84. A counterbore 86 defined in the projection 82 extends perpendicularly to the longitudinal axis 26 and slidably supports a locking pin or plunger 88.

[00038] The foundation 80 includes a concave part-cylindrical bottom surface 90 corresponding in size and shape to the outer surface 92 of the outer tube 24. The bottom surface 90 extends less than 180 degrees about the circumference 92 of the tube 24, allowing the bottom surface 90 to be pressed against the outer tube 24 and adhesively secured. The foundation 80 also includes an outer surface 94 opposite to the bottom surface 90. This outer surface 94 includes at least one flat outer surface 96 extending tangentially to the circular bottom surface 90. A cross section of this outer surface 94 preferably defines a polygon segment of flat surfaces, such as one half of an octagon as shown in Figure 6. Preferably, the projection 82 extends laterally from a centrally located flat surface 96 on the foundation 80.

[00039] A plurality of holes 102 located on the post 22 have a force-bearing diameter 104 for receiving the plunger 88 and holding the post 22 in a fixed position relative to the hollow tube 24. The plunger 88 has a force-bearing section 106 that is slidably supported by a force-bearing length 108 of counterbore 86 within the projection 82 and foundation 80. This force-bearing section 106 of plunger 88 is fully supported along the entire force-bearing length 108 of counterbore 86 when the plunger 88 engages the holes 102 in the post 22. In addition to the force-bearing section 106, the plunger 88 includes a disk 110 extending radially from the plunger

**88.** The disk **110** has a disk diameter **112** greater than the force-bearing diameter **104** and is slidably supported inside the counterbore **86** by a disk-bearing length **114** of counterbore **86**.

[00040] The projection **82** defines a height **116** along the longitudinal axis **26**, and a width **118** perpendicular to the height **116**. Preferably, the height **116** is greater than the width **118**. The projection **82** also defines a wall thickness **120** surrounding the counterbore **86**. Preferably the wall thickness **120** is greater in the direction of the height **116** than in the direction of the width **118**, making the projection **82** strongest along the longitudinal axis **26** to bear the shearing forces on the plunger **88** while keeping the projection **82** dimensions small.

[00041] In the remote controlled magnetic switch assembly **29** shown in Figures 1-7, the plunger **88** is preferably manipulated via a push-pull cable **122** connected to a remote thumbswitch **124**. The push-pull cable **122** is of the type commonly used in bicycles, with an outer sheath **126** that movably supports an inner control cable **128**. A housing **130** is integral with the distal end **84** of the projection **82** and covered by a main unit endcap **132**. The endcap **132** is secured to the housing **130** by two cap screws **134** that extend through endcap holes **136** in the endcap **132** and thread into cap screw holes **138** in the projection **82**.

[00042] A slider bar or slider shoe **140** is disposed in the housing **130**, below the endcap **132** and above the plunger **88**, for sliding movement inside the housing **130** along a slider axis **142** between a first position **144** and a second position **126**. The disk **110** section of the plunger **88** includes a plunger magnet **148** having a plunger magnetic polarity facing the slider bar **140**. The slider bar **140** includes an attracting magnet **150** having an attracting magnetic polarity opposite to the plunger

magnetic polarity. The attracting magnet 150 is embedded in the slider bar 140 to be centered over the plunger magnet 148 when the slider bar 140 is in the first position 144, thereby disengaging the plunger 88 from the post 22 when the slider bar 140 is in the first position 144. Preferably, the first position 144 is defined when the slider bar's motion along the slider axis 142 is checked by contact with the housing 130. The slider bar 140 also includes a repelling magnet 152 having a repelling magnetic polarity matching the plunger magnetic polarity. The repelling magnet 152 is embedded in the slider bar 140 to be centered over the plunger magnet 148 when the slider bar 140 is in the second position 126, thereby engaging the plunger 88 with the post 22 when the slider bar 140 is in the second position 126. Preferably, the second position 126 is defined when the slider bar's motion along the slider axis 142 is checked by contact with the housing 130 at the end of the slider axis 142 opposite to the first position 144.

[00043] The housing 130 includes a pair of threaded screw holes 154 in the direction of the slider axis 142 and tension set screws 156 threaded into these screw holes 154. A pair of slider bar springs 158 fit into a pair of spring holes 160 disposed on the slider bar 140 and mesh with the tension set screws 156 in the housing 130. The slider bar springs 158 force the slider bar 140 into the second position 126. Additionally, the housing 130 and slider bar 140 have a rounded shape 162 opposite to the slider bar springs 158 to ensure that the slider bar 140 rests snugly when forced into the second position 126 by the slider bar springs 158.

[00044] A cable mount 164 disposed outside the housing 130 holds the cable's 122 outer sheath 126 against the housing 130 in a fixed position. The cable mount 164 is located on the same side of the housing 130 as the tension set screws 156 along

the slider axis 142, and the cable 122 extends parallel to the longitudinal axis 26 near the cable mount 164. The inner control cable 128 extends through a cable hole 166 in the housing 130 and connects to the slider bar 140 for moving the slider bar 140 in proportion to the pressure applied to the thumbswitch 124. In this first embodiment, the thumbswitch 124 counteracts the force of the tension set screws 156 to move the slider bar 140 into the first position 144 and disengage the plunger 88 from the post 22. When the thumbswitch 124 is released, the slider bar 140 moves to the second position 126 and engages the plunger 88 with the post 22.

[00045] In the manual release assembly 30, the plunger 88 is manually manipulated. Referring to Figures 8-16, a knob supporting section 168 of plunger 88 extends from the disk 110 and has a diameter less than the disk 110, so that the disk 110 is located between the force-bearing section 106 and the knob supporting section 168. An endcap 132 is secured to projection 82 by two cap screws 134 that extend through endcap holes 136 in the endcap 132 and thread into cap screw holes 138 in the projection 82. The knob supporting section 168 of the plunger 88 extends through a knob hole 169 in the top cap 50, and a knob 170 is attached to the distal end 84 of the plunger 88 extending outside of the projection 82. A spring 174 disposed about the plunger 88 reacts between the disk 110 and the endcap 132, causing the plunger 88 to engage the post 22 until the knob 170 is pulled away from the tube 24 by manual manipulation.

[00046] In both embodiments, a bicycle seat 40 is mounted to the seat post assembly 20 using a seat clamp assembly 176 that attaches to the seat clamp mount 36. The seat post 22 is mounted to a bicycle 34 by attaching the tube 24 to the bicycle 34 in the same manner as an ordinary seat post 22. During this seat mounting process,

the seat height 116 relative to the bicycle 34 is adjusted to be in a high position for optimal power, with the post 22 fully extended. After the seat is mounted, manipulation of the plunger 88 to extend or distend the post 22 allows the seat to transition between a high position and a low position while the bicycle 34 is being ridden. During competitive mountain biking, for example, a rider can quickly lower the seat by operating the lever to unlatch the locking pin 88 from the inner post 22 while maintaining sufficient body weight on the seat to overcome the constant upward force of the main spring 76. Once the inner post 22 begins to move downwardly, the rider can release the lever and the pin will drop into the upper-most hole of the inner post 22 to lock the inner post 22 in the lowered position. To return the seat to the fully raised condition, the lever is again actuated to unlatch the pin 88 while the user lifts his body to decrease the counterweight on the seat by an amount sufficient to enable the main spring 76 to raise and return the inner post 22 to the fully raised position.

[00047] The invention further contemplates that the magnetic switch per se can be used apart from the seat post application in any of a number of other applications calling for a locking mechanism.

[00048] Obviously, many modifications and variations of the present invention are possible in light of the above teachings. The invention may be practiced otherwise than as specifically described within the scope of the claims. In addition, the reference numerals in the claims are merely for convenience and are not to be read in any way as limiting.